HIGHWAY RESEARCH REPORT

ANALYSIS OF VOLUME CHANGE TEST OF PORTLAND CEMENT MORTAR

STATE OF CALIFORNIA

TRANSPORTATION AGENCY

DEPARTMENT OF PUBLIC WORKS

DIVISION OF HIGHWAYS

MATERIALS AND RESEARCH DEPARTMENT

RESEARCH REPORT

NO. M & R 631133-8

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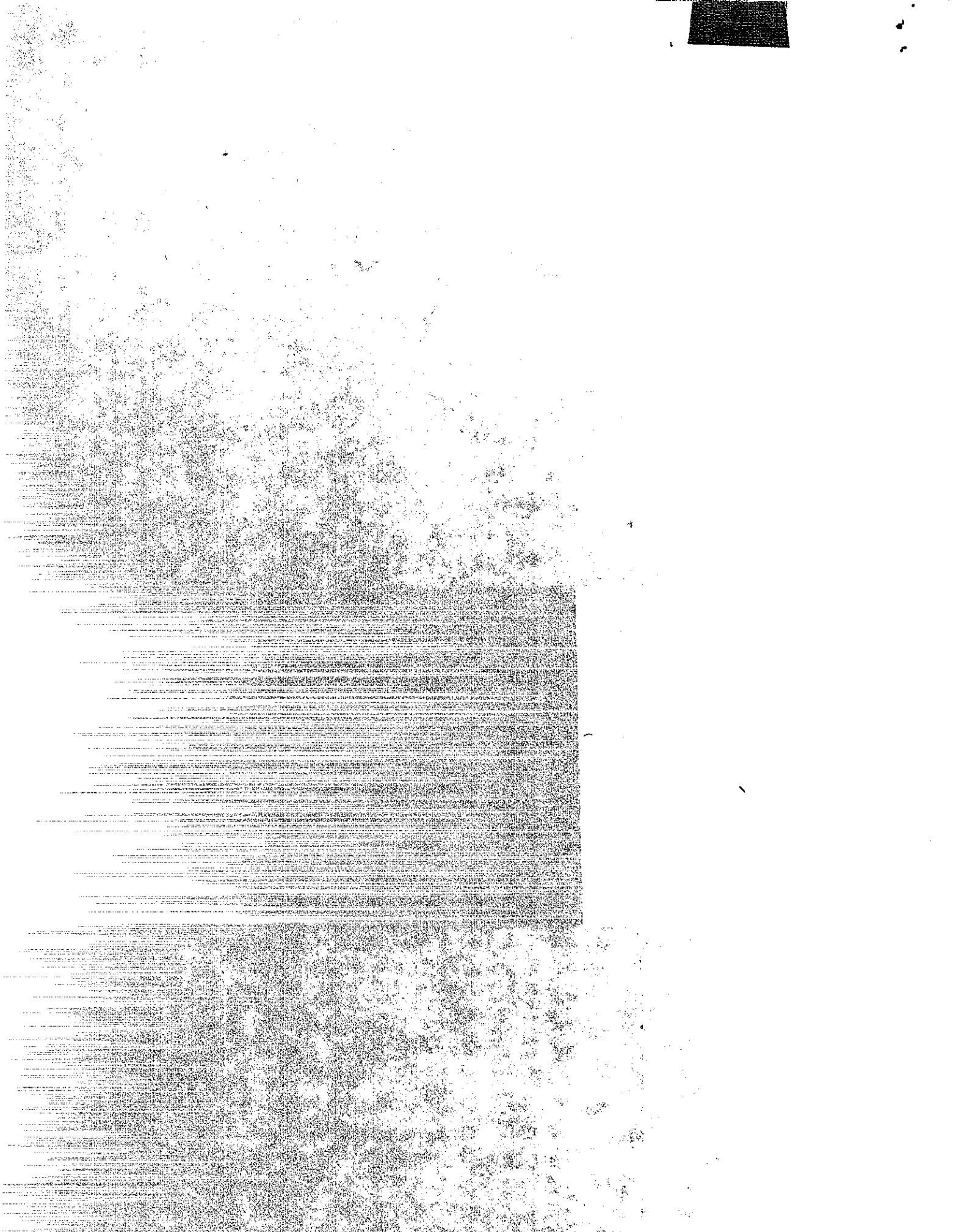


November, 1967

Interim Report
M&R No. 631133-8

Mr. J. A. Legarra
State Highway Engineer

Dear Sir:

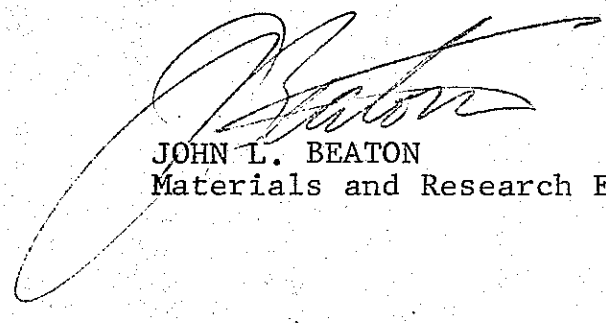
Submitted herewith is a research report titled:

ANALYSIS OF VOLUME CHANGE TEST
OF PORTLAND CEMENT MORTAR

George B. Sherman
Principal Investigator

Robert O. Watkins
Co-Investigator

Very truly yours,



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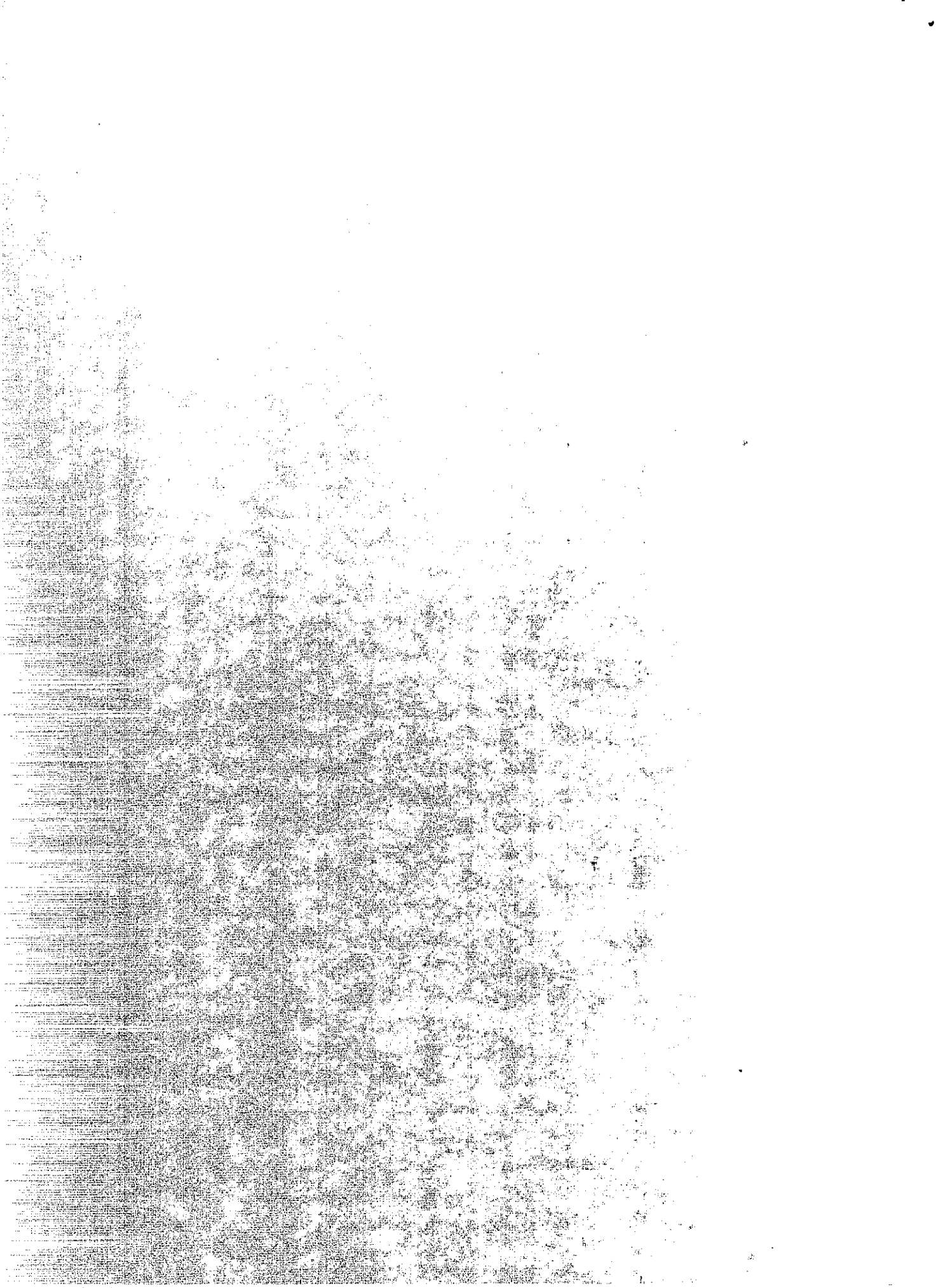
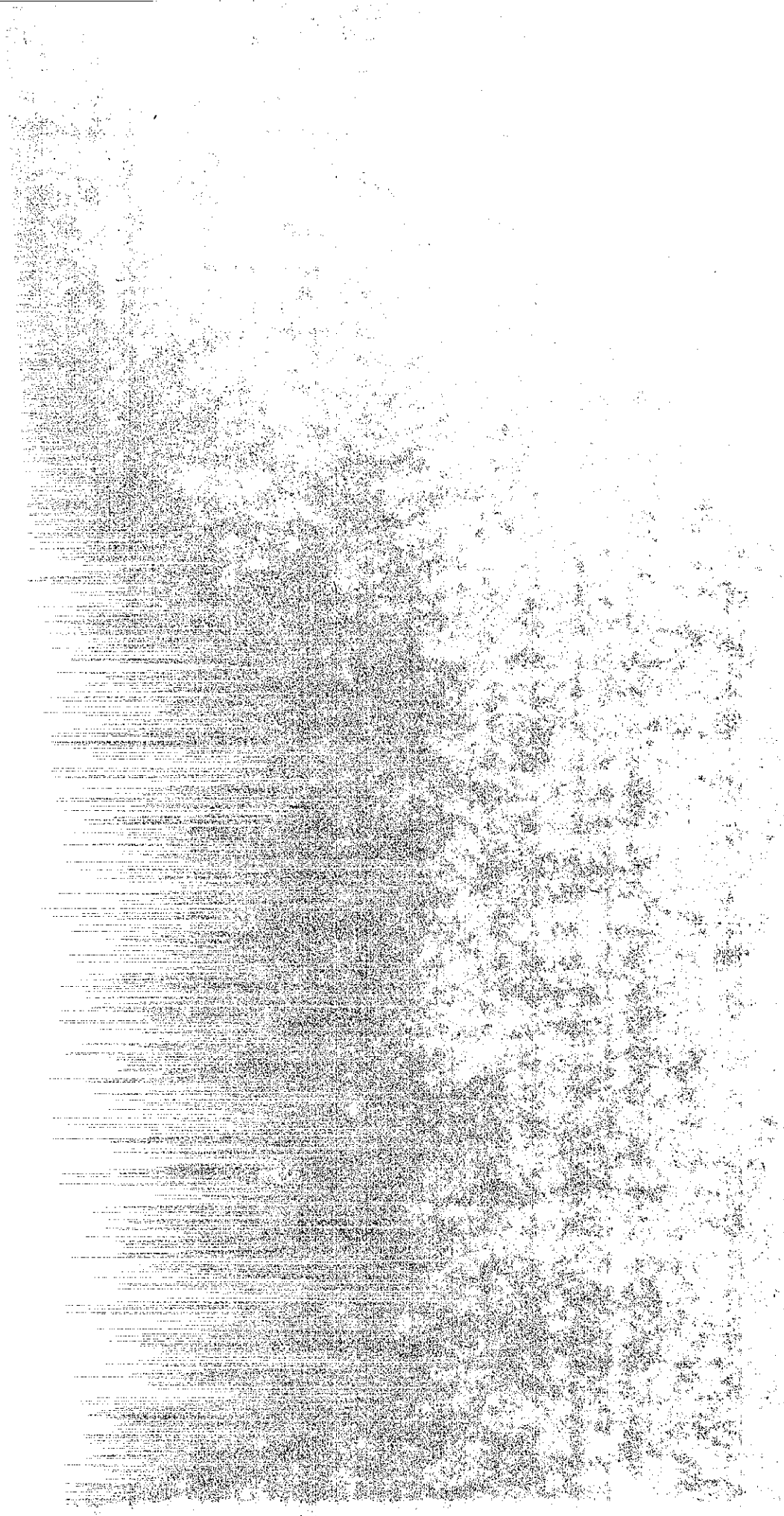


REFERENCE: Sherman, G. B. and Watkins, R. O.; "Analysis of Volume Change Test of Portland Cement Mortar"; State of California, Department of Public Works, Division of Highways, Materials and Research Department; Research Report; November 1967.

ABSTRACT: This report covers a study of the expansion in water -- contraction in air test for Type II portland cement mortar. The data were collected from tests performed in the Materials and Research Laboratory from June 1963 to August 1966. Test Method No. Calif. 527 was used. The study indicates no need for changes in our current specifications.

KEY WORDS: portland cement, mortars, expansion contraction, specifications, test method, test results, statistical analysis.



ANALYSIS OF VOLUME CHANGE TEST OF PORTLAND CEMENT MORTAR

INTRODUCTION

A research project consisting of study on control procedures for various construction materials was approved by the Bureau of Public Roads in 1964. Several studies have since been completed to determine the magnitude of the parameters required for the preparation of statistical specifications for these construction items. One of the control tests included in the proposal was the expansion in water -- contraction in air test for portland cement mortar. This short interim report contains the results and conclusions of a study of Type II portland cement mortar expansion in water -- contraction in air test results.

This report was prepared in cooperation with the U. S. Department of Transportation, Federal Highway Administration, Bureau of Public Roads. The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the Bureau of Public Roads.

CONCLUSIONS

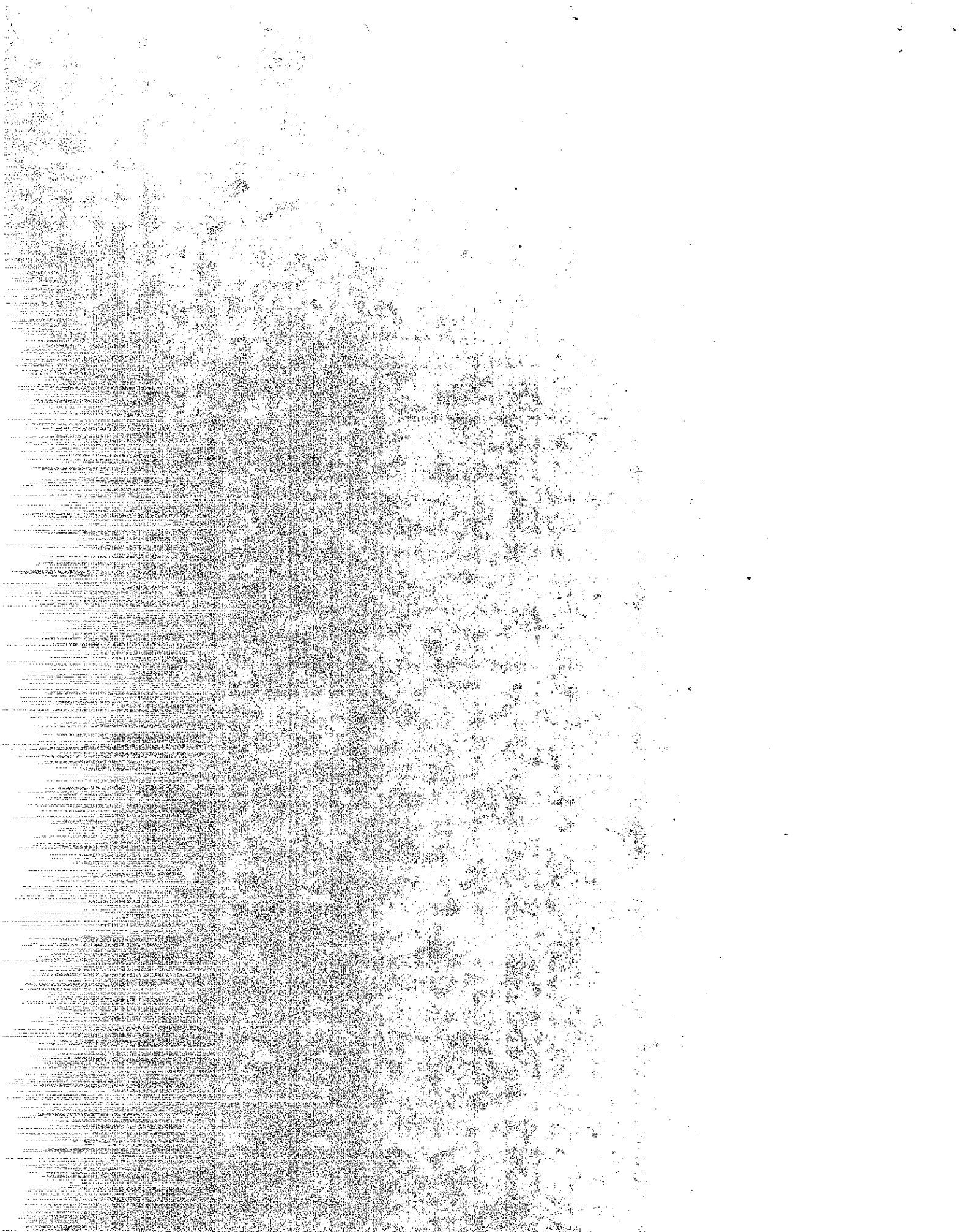
The results of this study indicate that the present specification limits are being satisfied with current construction and control procedures in almost all instances. At present, there appears to be no need for revisions in the current specification for the control of expansion in water -- contraction in air of portland cement mortar (Test Method No. Calif. 527-C).

RECOMMENDATION

It is recommended that the present test method and specification limits not be modified.

CONDUCTION OF STUDY

The data analyzed for this study consisted of all the test results in Type II portland cement that had been received in the Headquarters Laboratory from June 1963 to August 1966. Test Method No. Calif. 527 was used for the conduction of the tests. Each reported test result was an average of the change in length of four specimens from the same batch of mortar. Included in this test method is a criteria to be used to determine the acceptability of the test results. The test procedure



required that the standard deviation of the four test results not exceed 0.002 inches. If this criteria is not satisfied, the test is to be repeated. Consequently, this requirement limits the amount of testing variance.

Five companies supplied all the cement which was tested from a total of 14 different plants. No differentiation between company or plant was considered when analyzing the data.

DISCUSSION

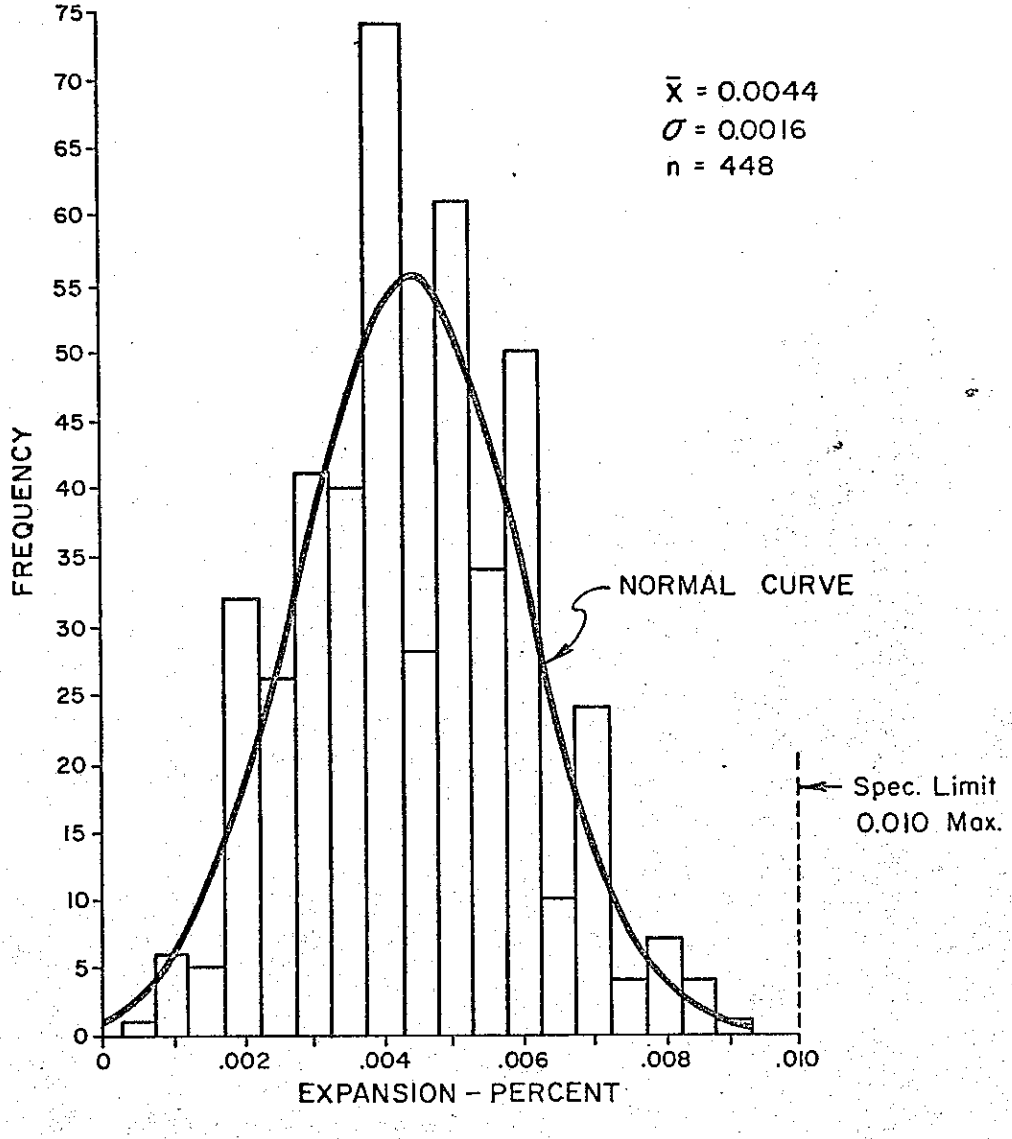
Figure A-1 contains histograms of the data for both expansion in water and contraction in air. The current specification limits of 0.010 percent expansion and 0.048 percent contraction (0.053 for prestress concrete) are shown on the figures.

The analysis in this report is based on the assumption that the population from which these test samples were drawn is normal; however, random sampling was not used to obtain the test samples.

All of the test results were within the specifications for expansion in water, thus indicating that the contraction in air may be the controlling feature. The percentage of the test results that did not meet the more restrictive specification of 0.048 percent maximum was 6.7 percent. The predicted percentage of the test results that would not meet the specification, using the normal curve, was also 6.7 percent. Thus, the present specification limits appear realistic and good control is being maintained.

Figure A-I

EXPANSION IN WATER OF TYPE II PORTLAND CEMENT MORTAR



CONTRACTION IN AIR OF TYPE II PORTLAND CEMENT MORTAR